ZIMSEC

For Performance Measurement

Zimbabwe School Examinations Council

O-LEVEL

PHYSICS

5055

EXAMINATION SYLLABUS FOR 2013-2017

CONTENTS

Additional copies of the syllabus can be ordered from ZIMSEC.

All correspondence should be addressed to:

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL
P O BOX CY 1464
CAUSEWAY
HARARE

TEL: 304551-3
FAX: 302288; 339080; 333889
E-MAIL: enquiries@zimsec.co.zw

PREFACE

In November 2013 – 2017 the following syllabuses will be examined by the Zimbabwe School Examinations Council (ZIMSEC).

1122	English Language
2013	Literature in English
2042	Religious Studies A
2043	Religious Studies B
2166	History
2248	Geography
2283	Economics
3011	French
3155	Ndebele
3159	Shona
4008/4028	Mathematics
5006	Integrated Science
5008	Biology
5009	Physical Science
5035	Agriculture*
6015	Art*
6035	Woodwork*
6045	Metalwork*
6051	Fashion & Fabrics*
6064	Food and Nutrition*
6078	Home Management*
7014	Computer Studies*
7035	Building Studies*
7049	Technical Graphics*
7103	Commerce
7112	Principles of Accounts
2157	History Word Affairs since 1919
2167	History Southern and Central Africa
2252	Sociology
2292	Law
3001	Latin*
3025	German*
3035	Spanish*
3151	Afrikaans*
4033	Additional Mathematics*
4034	Additional Mathematics*
4041	Statistics*
5055	Physics*
5071	Chemistry*
5097	Human and Social Biology
5027	Science (Physics/Biology)
5128	Science (Chemistry/Biology)
6020	Music*
7108	Commercial Studies*
7116	Business Studies*

* Indicates syllabus not available in June

PHYSICS

ORDINARY LEVEL

Subject 5055

Introduction

The syllabus is designed to have less emphasis on purely factual material, but a much greater emphasis on the understanding and application of physical concepts and principles. This approach has been adopted in recognition of the need for students to develop skills that will be long-term value in an increasingly technological world.

Aims

The aims of the science curricula are the same for all students. These are set out below and describe the educational purposes of an O level/School Certificate course in Physics. They are not listed in order of priority.

The aims are to:

1. provide, through well-designed studies of experimental and practical science, a worthwhile educational experience for all students, whether or not they go on to study science beyond this level and, in particular, to enable them to acquire sufficient understanding and knowledge

    1.1 to become confident citizens in a technological world, able to take or develop an informed interest in scientific matters;

    1.2 to recognize the usefulness, and limitations, of scientific method and to appreciate its applicability in other disciplines and in everyday life;

    1.3 to be suitably prepared for studies beyond the O level;

2. develop abilities and skills that

    2.1 are relevant to the study and practice of science

    2.2 are useful in everyday life

2.3 encourage efficient and safe practice

3. develop attitudes relevant to science such as:

3.1 concern for accuracy and precision

3.2 objectivity

3.3 integrity

3.4 enquiry

3.5 initiative

3.6 inventiveness

3.7 innovativeness

4. promote awareness that:

4.1 the study and practice of science are co-operative and cumulative activities, that are subject to social, economic, technological, ethical and cultural influences and limitations

4.2 the applications of sciences may be both beneficial and detrimental to the individual, the community and the environment

4.3 stimulate interest in and care for the environment

Assessment Objectives

The skills appropriate to Physics may, for convenience, be broadly categorized as follows:

A. Knowledge with understanding
B. Handling information
C. Experimental skills and investigations and solving problems.

A description of each of these categories is given below:

A. Knowledge width understanding

Students should be able to demonstrate knowledge with understanding in relation to:

1. scientific phenomena, facts, laws, definitions, concepts, theories

2. scientific vocabulary, terminology, conventions (including symbols, quantities and units)

3. scientific instruments and apparatus, including techniques of operation and aspects of safety

4. scientific quantities and their determination

5. scientific and technological applications with their social, economic and environmental implications

The syllabus content defines the factual knowledge that candidates may be required to recall and explain. Questions testing these objectives will often begin with one of the following words: define, state, describe, explain or outline. (See the glossary of terms).

B. Handling information and solving problems

Students should be able – using visual, aural and written (including symbolic, diagrammatic, graphical and numerical) information – to:

1. locate, select, organise and present information from a variety of sources, including everyday experience

2. translate information from one form to another

3. manipulate numerical and other data

4. use information to identify patterns, report trends and draw inferences

5. present reasoned explanations for phenomena, patterns and relationships

6. make predictions and hypotheses

7. solve problems

C. Experimental skills and investigations

Students should be able to:

1. follow instructions

2. carry out techniques, use apparatus, handle measuring devices and materials effectively and safely

3. make and record observations, measurements and estimates with due regard to precision, accuracy and units

4. interpret, evaluate and report upon observations and experimental data

5. identify problems, plan and carry out investigations, including the selection of techniques, apparatus, measuring devices and materials

6. evaluate methods and suggest possible improvements

D. Mathematical Requirements

Many topics in the syllabus provide opportunities for quantitative work, including appropriate calculations. The mathematical knowledge and skills which students may need in order to cope with the specified objectives and content are listed below. Calculators may be used in all papers.

Candidates will be expected to:

- recognize and use expressions in decimal form
- add, subtract, multiply and divide numbers, including decimal numbers and common fractions
- make approximations and estimates to obtain quick, order-of-magnitude answers or to make simple mental checks of answers obtained by a calculator
- calculate and use, averages, ratios, direct and inverse proportion and percentages
- draw and interpret graphs, bar and pie charts
- measure dimensions of common shapes
- manipulate and solve simple equations

Testing of assessment objectives

The skill areas listed under **B** also form the Assessment Objectives which the examination is designed to test. Such assessment objectives cannot readily be fully specified in the syllabus content. One reason is that questions testing skills in Physics may be based on information (given in the question paper) which is unfamiliar to the candidates or on everyday experience. In answering such questions, candidates are required to use principles and concepts that are within the syllabus and apply them in a logical manner.

Questions testing these objectives will often begin with one of the following words: predict, suggest, calculate, or determine. (See the glossary of terms)

Weightings of Assessment Objectives

Theory Papers (Paper 1 and 2)

A Knowledge with understanding, approximately 65% of the marks for the subject with approximately 30% allocated to recall.

B Handling information and solving problems, approximately 35% of the marks for the subject

Practical Assessment (Papers 3 and 4)

This is designed to test appropriate skills in C Experimental skills and investigations, and will carry 20% of the marks for the subject.

Scheme of Assessment

Candidates are required to enter for Papers 1, 2 and either Paper 3 or Paper 4.

Paper	Type of paper	Duration	Marks
1	Multiple Choice	1 h	40
2	Theory	1 h 45 min	75
3	Practical Examination	2 h	30
4	Alternative to Practical (written)	1 h	30

Paper 1 (1h, 40 marks)	Theory consisting of 40 compulsory multiple choice items of the direct choice type. These questions will involve 4 response items.
Paper 2 (1h 45 min, 75 marks)	Theory. The paper will contain 2 sections. Section A will carry 45 marks and will consist of a number of compulsory structured questions of variable mark value. Section B will carry 30 marks and will consist of 3 questions. Each question will carry 15 marks. Candidates will be required to answer 2 questions from Section B.
Paper 3 (2h, 30 marks)	Practical test. This paper will consist of two sections. Section A will contain 3 compulsory questions, each carrying 5 marks and each of 20 minutes' duration. Section B will contain one question carrying 15 marks and of one hour's duration.
Paper 4 (1h, 30 marks)	Alternative-to-Practical. A written paper consisting of compulsory short-answer and structured questions designed to test experimental skills and familiarity with laboratory practical procedures.

E Methodology

Emphasis is placed on the acquisition of experimental skills through practical experience. Experiments should be planned and designed in advance. A pupil-centred problem-solving approach should be adopted. Individual and group work is encouraged.

Emphasis must be on the understanding of concepts rather than on the memorization of specific examples that illustrate these concepts.

The syllabus is a two-year course of study. A minimum 3 teaching hours per week is required.

Teachers may use an integrated, co-ordinated or topic-based approach or any other suitable style of organization and delivery. Emphasis on investigations and practical work is expected. Schools are encouraged to rearrange the topics to suit their own conditions.

SI units of measurement are to be used, together with those units in common scientific use.

Where it will facilitate learning, the drawing of diagrams should be encouraged.

Guidance should be given on the correct taking of notes and writing up of experiments.

Safety precautions must always be observed.

SUBJECT CONTENT

The attention of teachers is drawn to the publication Signs, Symbols and Systematics. (The ASE Companion to 5-16 Science, 1995)
Reference should also be made to the summary list of symbols, units and definitions of quantities in the glossary. Throughout the course, attention should be paid to showing the relevance of concepts to the student's everyday life and to the natural and man-made world. The notes and activities in the last column are in no way exhaustive.

TOPIC	LEARNING OBJECTIVES	CONTENT	SUGGESTED NOTES AND ACTIVITIES
1.0 GENERAL PHYSICS	Pupils should be able to:		
1.1 Measurements	- measure physical quantities; - read an instrument scale to the nearest fraction of a division;	Length area, volume, mass, time, temperature	using a ruler, vernier calipers, thermometer, balance stop-watch, micrometer screw gauge, measuring cylinder, ammeter, voltmeter, forcemeter
	- determine density;	Liquids, regular, irregular objects	determining density experimentally for liquids, regular and irregular objects
	- express quantities in terms of S.I. units;	S.I. units	relate density to flotation and sinking
	- derive other units from base units.	Newton, joule watt, volt and others	metre (m), second (s), kilogram (kg), kelvin (K); ampere (A)
1.2 Scalars and vectors	- distinguish between scalar and vector quantities;	scalars and vectors	Give common examples.
	- determine resultant vectors.	two coplanar vectors	Graphical method can suffice.
2.0 KINEMATICS			
2.1 Speed, Velocity and Acceleration	- define displacement, speed, velocity and acceleration;	displacement, speed, velocity and acceleration.	use of ticker tape timer experiment or any other method
2.2 Graphs of motion	- plot, draw and interpret graphs of motion;	distance – time graph speed – time graph slope of graphs:+ve or –ve acceleration	slopes of graphs, area under graphs
	- determine acceleration, speed and distance from graphs;	area under graph: distance	
2.3 Motion under gravity	- define free-fall; - describe qualitatively the motion of bodies falling in a uniform gravitational field;	free-fall terminal velocity	experiments to show that objects fall at the same rate

TOPIC	LEARNING OBJECTIVES	CONTENT	SUGGESTED NOTES AND ACTIVITIES
3.0 FORCES 3.1 Effect of force on shape	- explain the effects of a force on size and shape of material; - plot, draw and interpret extension – load graphs. - explain Hooke's Law; -describe the associated experimental procedure.	Deformation of solids Tension and compression Hooke's Law	Experiments with foam rubber, springs, modeling putty, elastic bands. simple, experiments to demonstrate Hooke's Law. Treatment up to limit of proportionality in simple calculations.
3.2 Effect on motion	- define weight, momentum and inertia; - explain each of Newton's three laws of motion; - use relation between force, mass and acceleration;	weight, momentum, inertia; F = ma,	Limited to linear motion. Conservation of momentum is not required.
	Pupils should be able to: - explain the effect of friction on the motion of a body; - describe the ways in which force may change the motion of a body; - describe qualitatively motion in a curved path due to a perpendicular force;	 Friction Methods of reducing friction.	 No reference to static and dynamic co-efficient of friction. Advantages and disadvantages of friction. $(F = \frac{mv^2}{r}\ is\ not\ required)$
3.3 Turning effect of a force	- define moment of a force; - describe the moment of a force in terms of its turning effect and give everyday examples; - perform and describe an experiment to verify the principle of moments; - make calculations involving the principle of moments;	Moments, principle of moments. Turning effect of a force.	Illustrating using everyday examples. experiments to demonstrate clockwise and anticlockwise moments. solving simple problems.

TOPIC	LEARNING OBJECTIVES	CONTENT	SUGGESTED NOTES AND ACTIVITIES
3.4 Centre of mass	- define centre of mass; - determine the centre of mass of a plane lamina; - describe qualitatively the effect of the position of the centre of mass on the stability of objects.	Centre of mass Regular and irregular lamina and other objects. Stable, unstable and neutral equillibria.	experiments to determine position of centre of mass of regular and irregular lamina and other objects.
3.5 Pressure	Pupils should be able to: - define pressure; - calculate pressure;	Pressure P = F/A	Calculating pressure of solid objects using appropriate units.
	- calculate pressure in fluids; - describe effect of depth on pressure; - describe atmospheric pressure; - use bar patterns to predict type of weather including wind strength and direction; - describe the construction and use of a barometer; - describe the construction and use of a simple manometer;	Pressure in fluids Atmospheric pressure Manometer	$p = pgh$ experiments to demonstrate variation of pressure with depth demonstrating atmospheric pressure simple treatment of the barometer weather charts calculations on the manometer

TOPIC	LEARNING OBJECTIVES	CONTENT	SUGGESTED NOTES AND ACTIVITIES
4.0 WORK, ENERGY AND POWER 4.1 Work	- define work done; - calculate work done;	Work done;	simple experiments to illustrate work done Work = Force x distance
4.2 Energy	- define energy; - relate energy and work.	energy	forms of energy and their sources
	Pupils should be able to: - describe sources of energy;	Sources such as: i) Chemical/fuel (a re-grouping of atoms) ii) Hydrdoelectric generation (emphasis should be on the mechanical energies involved). iii) Sun (nuclei of atoms in the sun) iv) Nuclear (fission and fusion) v) Geothermal (e.g. geysers and hotsprings). vi) Wind vii) Tides (water waves in seas and lakes);	Sources of energy, including renewable and non-renewable. Heat, light, sound, electrical, chemical kinetic gravitational potential and nuclear energy.
	- describe energy changes from one form to another; - show a qualitative understanding of efficiency; - calculate gravitational potential energy and kinetic energy; - use the mass-energy equivalence equation	Energy conversions, energy converters, energy chains. Principle of energy conservation. $E_p = mgh$ $E_k = {}^{1}/_{2}\, mv^2$	experiments to show energy conversions energy chains everyday applications of energy conservation experiments to show relationship between E_p and E_k $E = mc^2$

TOPIC	LEARNING OBJECTIVES	CONTENT	SUGGESTED NOTES AND ACTIVITIES
4.3 Power	- define power; - relate power to rate of energy transferred; - perform calculations involving power.		Simple experiments to determine power. $\text{Power} = \frac{\text{Energy}}{\text{Time}}$ $\text{Power} = \frac{\text{Work done}}{\text{Time}}$
5.0 THERMAL PHYSICS 5.1 The kinetic theory of matter	Pupils should be able to: - describe states of matter in terms of kinetic theory; - explain the physical properties of matter; - describe qualitatively the thermal expansion of solids, liquids and gases; - explain the relative order of magnitude of expansions of solids, liquids and gases; - identify and explain some of the everyday applications and consequences of thermal expansion; - describe qualitatively the effect of a change of temperature on the volume of a gas at constant pressure;	Brownian motion. Solids, liquids and gases. Charles' Law	Practical activities to demonstrate change of state including sublimation simple experiments to – illustrate the properties. Melting boiling and evaporation. Diffusion – mixing due to molecular motion. simple experiments on Boyle's law.

TOPIC	LEARNING OBJECTIVES	CONTENT	SUGGESTED NOTES AND ACTIVITIES
5.2 Thermal Properties	- compare qualitatively order of magnitude of expansion of solids, liquids and gases; - explain applications and consequences of thermal expansion and contraction; - describe how a physical property which varies with temperature may be used for measurement of temperature.	Thermal expansion and contraction. Thermostats, thermometers, bridges, railway lines and electrical cables, etc. Measurement of temperature, fixed points liquid in glass thermometer (laboratory and clinical), thermocouple thermometer, advantages and disadvantages.	Experiments to compare expansion and contraction in solids, liquids and gases.
	- state such properties; - state the need for and identify fixed points; - describe sensitivity range and linearity; - describe different types of thermometers; - define melting point and boiling point; - describe melting and boiling in terms of energy transfer without change of temperature; - describe the effect of impurities and pressure on melting points and boiling points of substances;	Melting and boiling. Latent heat Impurities and pressure	Experiments on expansion and contraction of matter. Determine melting point and boiling point experimentally and graphically. Consider both heating and cooling curves. The influence of atmospheric pressure on melting points and boiling points to be discussed in terms of kinetic theory. Experiments to investigate the effect of impurities and pressure on melting and boiling point.

TOPIC	LEARNING OBJECTIVES	CONTENT	SUGGESTED NOTES AND ACTIVITIES
	Pupils should be able to: - determine the specific heat capacity of a liquid and a solid; - calculate the heat capacities of objects from experimental data; - explain why different materials have different heat capacities; - define specific latent heat; - calculate specific latent heat;	Definition of specific heat capacity(c). Heat supplied = heat gained Explanation based on particles Fusion, vaporization Heat supplied = heat gained.	Determining specific heat capacity by experiments. $Q = mc(\theta_2 - \theta_1)$ Carrying out calculations on specific heat capacity. Explaining differences in heat capacities. Determining specific latent heat experimentally. $Q = mL \; or \; ml$ calculations involving specific latent heat. (Assumption: No heat is lost or gained to surrounding).
5.3 Heat Transfer	- identify good and bad conductors of heat; - give a molecular account of heat transfer in solids; - relate convection to density changes in liquids and gases;	Metals, non-metals, liquids and gases Conduction Convection	Experiments to distinguish between good and bad conductors of heat. Experiments to demonstrate conduction. Experiments to demonstrate convection.

TOPIC	LEARNING OBJECTIVES	CONTENT	SUGGESTED NOTES AND ACTIVITIES
	- describe experiments to distinguish between god and bad emitters/absorbers of infra-red radiation; - deduce that good absorbers are also good emitters; - explain applications of conduction, convection and radiation; - describe the function and design of a solar water heater.	Infra-red radiation Good and bad emitters/absorbers; Solar cooker and vacuum flask, etc. Solar water heater.	Experiments with dull and bright surfaces. Experiments with parabolic reflectors. Experiments to demonstrate solar water heating.
6.0 WAVES 6.1 Wave properties	Pupils should be able to: - describe wave motion; - describe characteristics of a wave; - calculate velocity, frequency and wavelength;	Transverse and longitudinal waves Amplitude, wavelength, frequency and period	Experiments to demonstrate waves using slinky springs, ropes, ripple tanks, etc. Use of $T = \frac{1}{f}$ Use of $V = f \lambda$
	- describe propagation of waves in terms of wave fronts and rays.	Media for mechanical waves. Reflection and refraction wave fronts and rays.	Demonstrating reflection and refraction of wave fronts practically.
6.2 Sound	- describe how sound is produced; - describe longitudinal nature of sound waves; - state the approximate range of audible frequency; - explain the need of a medium in the transmission of sound waves; - describe experiments to determine the speed of sound in air; - relate pitch, loudness and quality of sound waves to amplitude and frequency;	Vibrations Compressions and rarefactions Transmission of sound Speed of sound Pitch, loudness and quality Reflection of sound Applications of echoes	tuning forks and simple musical instruments simple experiments with slinky springs. experiments with vacuum pump and electric bell. determining speed of sound practically. simple experiments on pitch, loudness and quality.

	- describe echoes.		No treatment of overtones. Simple experiments to demonstrate echoes.
6.3 Electromagnetic waves	- identify the regions of the electromagnetic spectrum in order of wavelength or frequency;	Electromagnetic spectrum	No recall of actual wavelengths or frequencies is required.
	- state the differences and similarities between electromagnetic waves; - state thee uses of the different components of the electromagnetic spectrum.	Wavelength, frequency, speed and transmission Uses of the different components.	Discussing differences and similarities between electromagnetic waves. Discussing applications of electromagnetic waves in communication cooking, medical field remote sensing etc.
7.0 OPTICS 7.1 Reflection of light	Pupils should be able to: - describe an experiment to illustrate the laws of reflection; - use the law: I = r, in reflection; - describe the position and characteristics of an optical image formed by a plane mirror; - perform simple constructions, measurements and calculations;	Laws of reflection, Formation of images by plane mirrors. Ray diagrams.	Experiments using plane mirrors. Experiment to find the image of an object.

TOPIC	LEARNING OBJECTIVES	CONTENT	SUGGESTED NOTES AND ACTIVITIES
7.2 Refraction of light	- state laws of refraction; - describe refraction using ray diagrams;	Dense and less dense media Refraction at plane surfaces.	Experiments to investigate refraction. $\frac{\sin i}{\sin r}$ = Constant Drawing ray diagrams to illustrate various situations of refraction.
	- describe refraction of light through transparent blocks and liquids; - define refractive index; - define critical angle; - describe total internal reflection; - describe applications of total internal reflection.	Apparent depth Ray diagrams Total internal reflection and critical angle. Fibre optics Glass prisms instruments.	Experiments to demonstrate apparent depth $\frac{\sin i}{\sin r}$ = n Experiments to determine refractive index. Experiments to demonstrate total internal reflection. Demonstrating application of total internal reflection in fibre optics; binoculars and periscope.
7.3 Lenses	Pupils should be able to: - describe the action of a converging lens and diverging lens on a beam of light; - draw ray diagrams to illustrate the formation of real and virtual images;	Converging and diverging lenses, focal point Nature and position of images	Experiments to show convergence and divergence Experiments on formation of real and virtual images by converging lens. No treatment of images formed by diverging lenses is required.

TOPIC	LEARNING OBJECTIVES	CONTENT	SUGGESTED NOTES AND ACTIVITIES
	- explain how to measure the focal length of a converging lens; - describe magnification of a converging lens; - describe the use of a single lens as a magnifying glass; - describe the use of a single lens to form a real image; - explain the use of lenses in the correction of short and long sight.	Focal length Magnification Magnifying glass Camera and projector Short and long	Experiments to measure the focal length of a converging lens. $m = \frac{v(distance\ to\ image)}{u\ (distance\ to\ object)}$ $= \frac{size\ of\ image}{size\ of\ object}$ Demonstrating the action of a magnifying glass. Carrying o simple demonstrations. No calculations required.
7.4 Dispersion of light	- describe the dispersion of light.	Visible spectrum;	Experiments on dispersion of light using a glass prism. Order of colours to be specified.
8.0 ELECTRICITY 8.1 Electrostatics	Pupils should be able to: - describe simple experiments to show electrostatic charging; - describe forces between charges;	 The electron, positive and negative charges. The Coulomb. Like and unlike charges	 Simple experiments to show electrostatic charging. Simple experiments to demonstrate attraction and repulsion of charges.

TOPIC	LEARNING OBJECTIVES	CONTENT	SUGGESTED NOTES AND ACTIVITIES
	- describe an electric field; - state and describe the direction of field lines and simple field patterns; - distinguish between conductors and insulators; - explain conductors and insulators; - explain separation by induction; - describe natural phenomena of static electricity;	Force on electric charge Field lines and field patterns Conductors and insulators Induced charge in conductors Lighting, safety precautions	Qualitative treatment only. Drawing diagram to show field patterns. Typical diagrams. Demonstrating inductive charging using electroscopes. Formation, dangers, earthing, shielding. Construction a lightning conductor.
8.2 Primary and secondary cells Electro-motive force	- use the concept that the emf is measured by energy dissipated by a source in driving a charge round a complete circuit; - show appreciation that the volt is given by J/C;	Emf	Sources of emf.
8.3 Current electricity	- explain the flow of current in a circuit; - use the equation $I = \frac{Q}{t}$; - measure current and voltage; - define potential differences;	Electron flow Ammeter, ampere, Conventional direction of current different ranges	Ammeter, ampere, the volt, voltmeter, milliampere range. Using a voltmeter to measure p.d.

TOPIC	LEARNING OBJECTIVES	CONTENT	SUGGESTED NOTES AND ACTIVITIES
	Pupils should be able to: - use the concept that the sum of the potential differences in a series circuit is the same as the potential difference across the whole circuit; - state and use Ohm's law; - describe an experiment to determine resistance using a voltmeter and an ammeter; - state the limitations of Ohm's law; - sketch and interpret the V/I characteristics graphs for metallic (ohmic) and non-ohmic conductors. - use the relationship between the resistance, length and cross-sectional area of a wrire.	Summation of voltage in aseries circuit. Resistance Experimental determination of resistance. Thickness and length of a conductors.	Experiments using voltmeter in a series circuit. $R = \frac{V}{I}$ Carrying out experiments to verify Ohm's Law and calculations involving Ohm's law. Carrying put experiments to determine resistance. Carrying out simple experiments to investigate the limitations. Variations of resistance of conductor with temperature (e.g. in a bulb), bending, tension or if placed in a strong magnetic field. Experiments to investigate the relationships. $R = p\frac{\ell}{A}$

TOPIC	LEARNING OBJECTIVES	CONTENT	SUGGESTED NOTES AND ACTIVITIES
8.4 Electric circuits	Pupils should be able to: - set up simple electric circuits; - draw and interpret circuit diagrams; - use the fact that the current from the source is the sum of currents in the separate branches of a parallel circuit; - calculate resistance in simple circuits;	 Cells, switches, resistors variable resistors, bulbs, ammeters, voltmeters and fuses. Series and parallel resistors.	 *Practical activities on electric circuits.* *Drawing and interpreting circuit diagrams.* $I=I_1+I_2+I_3$ *Calculations on series and parallel resistors.* $R=R_1+R_2+R_3$ $\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}$
8.5 Electricity in the home	- describe uses of electricity in the home; - calculate electrical power, energy and the cost of electricity; - describe electrical hazards and safety precautions; - describe the wiring of a three-pin plug; - explain the use of a two-pin plug; - explain the use of fuses, fuse ratings and switches;	Heating, lighting and motors, lamps in parallel The kilowatt-hour Hazards Safety precautions Live, neutral and earth Double insulation of appliance Fuses, switches on live wire;	Discussing uses of electricity in the home. P=VI E=Vlt Reading of electricity meters. Damaged insulation, overheating cables and damp conditions. Experiments demonstrating electrical hazards must NOT be done. Practical wiring of a plug. Examining appliances with double insulation.

			Demonstrating the operation of a fuse and a switch. Explaining why fuses and switches are always on live wire.
9.0 MAGNETISM 9.1 Magnetic properties	Pupils should be able to: - state the properties of magnets; - describe magnetic field lines around magnets; - explain induced magnetism; - describe methods of magnetisation; - describe methods of demagnetisation; - distinguish between magnetic and non-magnetic materials; - distinguish between the magnetic properties of iron and steel.	Polarity; Attraction and repulsion Magnetic field lines Pattern and direction Induction Single and double stroking, using a solenoid Demagnetisation by hammering, heating and electrical methods Magnetic and non-magnetic materials Relative ease of magnetisation and demagnetization temporary and permanent magnets.	Carrying out experiments to investigate properties of magnets. Plotting magnetic field lines. Experiments to demonstrate induced magenetism. Experiments to demonstrate magnetisation. Experiments to demonstrate demagnetisation. Magnetising and demagnetising pieces of iron and steel.
9.2 Application of magnetism	- describe uses of temporary magnets; - describe uses of permanent magnets.	Video and audio tapes, computer discs, electric bell Electric motors, loudspeakers, generators, telephone receivers.	Discussing uses of temporary magnets. Discussing uses of permanent magnets.

TOPIC	LEARNING OBJECTIVES	CONTENT	SUGGESTED NOTES AND ACTIVITIES
10.0 ELECTRO-MAGNETISM 10.1 Magnetic affect of an electric current	Pupils should be able to: - describe an experiment to demonstrate that a current-carrying conductor has a magnetic field around it; - describe an experiment to plot magnetic field patterns due to a current-carrying solenoid; - predict the direction of magnetic field of straight conductor and of a solenoid;	Magnetic field patterns Magnetic field patterns of solenoid Direction of magnetic field Right hand grip rule	Long straight conductor, solenoids. Demonstrating field around current-carrying conductor using iron fillings or plotting compass. Plotting magnetic field due to a solenoid. Predicting direction of field lines.
10.2 Force on current carrying conductor in a magnetic field	- describe the field patterns between parallel currents and relate these to the forces which exist between the currents; - describe an experiment to show that a current-carrying conductor in a magnetic field experiences a force; - predict the direction of motion of a current-carrying conductor in a magnetic; - describe the application of the magnetic effect of a current.	Force between parallel currents, field patterns Factors affecting magnitude of force Fleming's left hand rule Action of an electric bell and a simple relay.	Experiments on field patterns between parallel currents. Demonstrating the effect of a magnetic field on a current-carrying conductor. Experiments to show relationship between direction of current, field and motion
	Pupils should be able to: - describe the operation of a d.c. motor;	Electrical to mechanical energy	Constructing a simple d.c. motor Field, current and motion, turning effect commutator

TOPIC	LEARNING OBJECTIVES	CONTENT	SUGGESTED NOTES AND ACTIVITIES
10.3 Electromagnetic induction	- describe an experiment which shows that a changing magnetic field can induce an e.m.f. in a circuit or conductor; - state the factors affecting the magnitude of induced e.m.f; - use the fact that direction of an induced e.m.f opposes the change producing it; - predict the direction of induced current in a conductor; - describe the operation of an a.c. and d.c. generator.	The generator principle Strength of magnet, relative motion, number of turns, area of coil. Lenz's law Fleming's right hand rule mechanical to electrical energy	An experiment with a coil, a magnet and a galvanometer. Experiments to investigate factors. No calculations required. Using Flemming's right hand rule to make predictions. Slip rings, voltage-time graphs, commutator. Illustrating output voltage graphically and discussing the factors affecting output voltage.
10.4 Transformers	Pupils should be able to: - describe the structure and principle of operation of a basic iron-cored transformer; - use the equations $V_pN_s=N_pN_s$ and $V_pI_p=V_sI_s$ for 100% efficiency; - describe the use of transformer in high-voltage transmission; - discuss the energy loss in cables; - give advantages of high voltage transmission;	Primary and secondary coils, laminated core, voltage transformations, efficiency, cooling and eddy currents. Current and potential difference in step-up and step-down transformers.	Demonstrating the operation of a simple transformer. Calculations using the transformer equations. The advantages of high-voltage transmission.

TOPIC	LEARNING OBJECTIVES	CONTENT	SUGGESTED NOTES AND ACTIVITIES
11.0 ELECTRONICS 11.1 Thermionic emission	- explain that a hot filament emits electrons; - describe how these electrons can be directed into an electron beam;	Emission of electrons from hot metals Acceleration and collimation of electrons	Demonstrate thermionic emission. Discussing acceleration and collimation of electrons.
	- describe the effect of a magnetic or electric field on an electron beam.	Bending of electron beam.	Direction of deflection of electron beam. Relate to TV tube and CRO.
11.2 Diodes	- describe the function of diodes	Function of diodes Circuit symbol, LEDs	Simple experiments to demonstrate the function of a diode.
11.3 Rectification	- define rectification - explain half and full wave rectification	Conversion of a.c. to d.c. Use of diodes, voltage – time graphs	Power supplies Experiments on rectification.
11.4 Electronic Components	Pupils should be able to: - describe the behavior of resistors; - use a given colour for resistance values; - choose components with suitable power ratings; - describe the action of a variable potential divider; - describe the action of thermostats and light dependent resistors; - describe the action of a capacitor; - explain the use of reed switches in circuits; - describe circuits incorporating light sensitive switches;	Colour codes for carbon resistors. Potentiometer use as in put transducers Energy store Time delay circuits	

TOPIC	LEARNING OBJECTIVES	CONTENT	SUGGESTED NOTES AND ACTIVITIES
12.0 Logic Gates	- describe logic gates	Logic gates: OR, AND, NOT, NAND and NOR	Constructing truth tables.
13.0 ATOMIC AND NUCLEAR PHYSICS 13.1 Atomic model	- describe the structure of an atom in terms of nucleus and electrons; - explain proton and nucleon numbers; - explain isotopes	Nucleus and electrons Composition of nucleus Proton number Z and nucleon number A. Nuclide notation, $^{A}_{Z}X$ Isotopes	Drawing diagrams of the atomic structure. Simple calculations on proton and nucleon numbers. Simple examples of isotopes.
13.2 Radioactivity	Pupils should be able to: - describe radioactivity; - state types of radioactive emission; - describe the nature and properties of radiation; - describe the mechanism of α and β decay; - explain the meaning of half-life; - distinguish between fusion and fission; - describe the uses of radioactive materials;	Radioactivity Stability of neclei, α and β particles and γ rays, detection Nature of radiation Nuclear decay; α , β decay γ radiation Decay curve Half-life Fusion and fission, nuclear reactions i) carbon – 14 dating ii) Biochemical tracers iii) Radiotherapy	The detection of radiation. Discussing nature and properties of radiation. Ionising effects, penetrating power and deflection by magnetic and electric fields; Calculating nucleon and proton numbers of balanced equations. Drawing and interpreting decay curves. Graphical representation of radioactive decay. Carrying out calculations on half-life.

		iv) Detection of leaks in pipes v)Determination of thickness of materials vi) Power generation vii) Sterilisation viii) Etc.	Uses of radioactive materials.
	Pupils should be able to: - describe how radioactive materials are handled, used and stored in a safe way. - describe the effects of radioactive emission on the environment.	Use, storage, handling Soil, waves, air, plant and animal life	Use of photographic film badges for exposure detection. The impact of radioactive emission on the environment.

GLOSSARY OF TERMS USED IN PHYSICS PAPERS

It is hoped that the glossary will prove helpful to candidates as a guide, although it is not exhaustive. The glossary has been deliberately kept brief not only with respect to the number of terms included but also to the descriptions of their meanings. Candidates should appreciate that the meaning of a term must depend in part on its context. They should also note that the number of marks allocated for any part of a question is a guide to the depth of treatment required for the answer.

1. Define (the term(s)…) is intended literally. Only a formal statement or equivalent paraphrase, such as the defining equation with symbols identified, being required.

2. What is meant by….. normally implies that a definition should be given, together with some relevant comment on the significance or context of the term(s) concerned, especially where two or more terms are included in the question. The amount of supplementary comment intended should be interpreted in the light of the indicated mark value.

3. Explain may apply reasoning or some reference to theory, depending on the context.

4. State implies a concise answer with little or no supporting argument e.g. a numerical answer that can be obtained 'by inspection'.

5. List requires a number of points with no elaboration. Where a given number of points is specified, this should not be exceeded.

6. Describe requires candidates to state in words (using diagrams where appropriate) the main points of the topic. It is often used with reference either to particular phenomena or to particular experiments. In the former instance, the term usually implies that the answer should include reference to (visual) observations associated with the phenomena. The amount of description intended should be interpreted in the light of the indicated mark value.

7. Discuss requires candidates to give a critical account of the points involved in the topic.

8. Deduce/Predict implies that candidates are not expected to produce the required answer by recall but by making a logical connection between other pieces of information. Such information may be wholly given in the question or may depend on answers extracted in an earlier part of the question.

9. Suggest is used in two main contexts. It may either imply that there is no unique answer or that candidates are expected to apply their general knowledge to a 'novel' situation, one that formally may not be 'in the syllabus'.

10. Calculate is used when a numerical answer is require. In general, working should be shown.

11. Measure implies that the quantity concerned can be directly obtained from a suitable measuring instrument e.g. length, using a rule, or angle, using a protractor.

12. Determine often implies that the quantity concerned cannot be measured directly but is obtained by calculation, substituting measured or known values of other quantities into a standard formula, e.g. the Young modulus, relative molecular mass.

13. Show is used when an algebraic deduction has to be made to prove a given equation. It is important that the terms being used by candidates are stated explicitly.

14. Estimate implies a reasoned order of magnitude statement or calculation of the quantity concerned. Candidates should make such simplifying assumptions as may be necessary about points of principle and about the values of quantities not otherwise included in the question.

15. Sketch, when applied to graph work, implies that the shape and/or position of the curve need only be qualitatively correct. However, candidates should be aware that, depending on the context, some quantitative aspects may be looked for, e.g. passing through the origin, having an intercept, asymptote or discontinuity at a particular value. On a sketch graph it is essential that candidates clearly indicate what is being plotted on each axis.

16. sketch, when applied to diagrams, implies that a simple, freehand drawing is acceptable; nevertheless, care should be taken over proportions and the clear exposition of important details.

17. Compare requires candidates to provide both similarities and differences between things or concepts.

MCN
C:MYDOCUMENTS:5055 2013-2017